Tactical Atmospheric Modeling System/Real-Time (TAMS/RT)

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LONG-TERM GOALS

The goal of this one-year accelerated technology initiative is to provide the forward deployed operator with the organic capability to add value to centrally-produced METOC products. The added value is realized by incorporating local data into an organically-controlled high resolution, limited-area, nonhydrostatic atmospheric analysis and forecast modeling system. The modeling system is the NRL Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS) which uses central site data products for the time-dependent lateral boundary conditions. The focus of the delivered system is to provide atmospheric and tactical impact variables (e.g., refractivity) at improved accuracy and resolution to operational users who need to predict the capabilities of sensor and weapon systems.

OBJECTIVES

Deliver a prototype NRL Tactical Atmospheric Modeling System/Real-Time (TAMS/RT) to the Naval Central Meteorology and Oceanography Facility (NCMOF), Bahrain and evaluate the system for one year. TAMS/RT is end-to-end on-scene analysis/forecast system for real-time organic data fusion which runs on a suite of dedicated computer hardware. TAMS/RT consists of the On-Scene Tactical Atmospheric Forecast Capability (STAFC) software hosted on two Silicon Graphics, Inc. (SGI) and one Hewlett-Packard (HP) TAC-4 computer systems. STAFC in turn is built upon the atmospheric component of the NRL COAMPS model, which includes the Multi-Variate Optimum Interpolation (MVOI) and COAMPS Ocean Data Assimilation (CODA) system. The Tactical Environmental Database System (TEDS) and Complex Quality Control (QC) software are also integral components of STAFC and provides data ingest, storage, management, and dissemination capabilities.

APPROACH

Procure the SGI and HP computer systems, an uninterruptible power supply, a high speed network switch, and a license for the Informix commercial database. Extend the Graphical User Interface (GUI) to allow control of the hourly rapid environmental assessment (REA). Adapt the NRL Integrated Portable Visualization System (IPVS) to automatically update output graphical products on a dedicated web server. Enhance the TEDS database to manage the satellite-derived cloud drift and water vapor tracked wind data. Accelerate the development of an internet-based remote monitoring web page that will allow NRL developers to check on system and data status. Integrate the software components on the computer systems and test locally. Develop a User's Manual. Ship the integrated systems to NCMOF, Bahrain and install. Train operators to use the system, visualization tools, and web interface as part of their collateral duties and turn over the functioning system to NCMOF personnel. For a

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period of one year, remotely monitor the status of the system from NRL via the SIPRNET, and provide periodic (approximately monthly) site visits to evaluate the system with respect to its skill, usability, interoperability, and reliability, and develop the concept of operations. (John Cook (NRL), Pedro Tsai (NRL), Larry Phegley (NRL), Dr. Jerry Schmidt (NRL), Sue Chen (NRL), Audrey Wakefield (A&T), Mike Frost (A&T), Linda Frost (CSC), Mugur Georgescu (CSC), John Kent (SAIC), Lari Nell Migues (NSI), and Jim Mundy (A&T) performers.)

WORK COMPLETED

The procurement, development, and integration phases of the project have been completed. In anticipation of a September 1998 delivery, most of the equipment has been shipped and awaits installation on site. Delays in SIPRNET installation at the Facility and travel restrictions to the Middle East theater have pushed the installation into November 1998, with the remaining equipment scheduled for shipment in mid-October.

The GUI has been enhanced to control the REA nowcast and, in coordination with project N0001498WX30164 (EM/EO Testbed), the GUI has been simplified to make it easier to use and to provide the user with improved feedback on the status of COAMPS. In coordination with NRL visualization project (N0001498WX400008 NRL BE-35-2-21), IPVS has been adapted to TAMS/RT and modified to provide a better set of user defined graphical products. In coordination with the 6.4 SPAWAR PMW 185 project PE 0603207N X1752-01, the TEDS database has been enhanced to manage satellite-derived cloud drift and water vapor tracked wind data. Initially, the satellite data will be provided by NRL contract with the University of Wisconsin - Madison Cooperative Institute for Meteorological Satellite Studies (CIMSS). Later in the project, the satellite data feed will transition to the on-scene Navy Satellite Display System – Enhanced (NSDS-E). TEDS also now supports both automatic ingest of undesignated COAMPS domains and retransmission of fields for dissemination. The remote monitor (RMON) software has also been developed and the TAMS/RT User Manual has been written and distributed.

TAMS/RT has been running on a routine daily basis at NRL Monterey and has been installed operationally at the Navy Pacific METOC Facility (NPMOF), San Diego, since May 1998 with additional support from SPAWAR PMW 185 (PE 0603207N X0513-05). The purpose of the system at NPMOF is to provide end-state user feedback and lessons learned before the installation at NCMOF, Bahrain. Examples of areas where detailed COAMPS forecasts have been provided include Bosnia, several areas along the California coast, Antarctic, Pacific Northwest, Hawaii (operational support for the RIMPAC 98 fleet exercise), and several tropical storms. The COAMPS products have been made available on the web server in real time.

RESULTS

For the first time, the Navy is capable of locally analyzing real-time on-scene observations to assess the atmospheric environment and generate an automated forecast. The cutting-edge capability provided by TAMS/RT is the high-resolution analysis and prediction of atmospheric and tactical impact variables. The experiences at NRL and NPMOF, San Diego have led to several improvements in TAMS/RT by simplifying the GUI, providing better user feedback on the status of COAMPS runs, and allowing more flexibility by initializing the model with either global or mesoscale fields. The ability to run the MVOI

on-scene with satellite-derived wind data provides a true organic REA nowcasting capability allowing forward-deployed forces to automatically maintain a database of the current environmental conditions updated hourly. In coordination with 6.4 SPAWAR PMW 185 project PE 0603207N X1752-01, the TEDS database has well defined application programmer interfaces (APIs) that have been used to provide data for the Vapor Liquid Solid Tracking (VLSTrack) NBC hazard model, Electro-Optical TDA (Windows EOTDA), Advanced Propagation Model (APM), and Stoplight Hazard Display aid. However, the development and testing of such a sophisticated system has not been without problems. Upgrades to the TEDS database were consolidated with a major upgrade to achieve DII/COE (Defense Information Infrastructure/Common Operating Environment) compliance, which resulted in a major unanticipated rewrite of the TEDS APIs. COAMPS, MVOI, and CODA have each undergone considerable development and the codes have been continuously monitored and upgraded in TAMS/RT. Perhaps the largest hurdle to overcome is the basic system administration associated with the high performance SGI and HP computer systems. There is a real lack of adequate training and technical support in the operational community for high technology UNIX computers and networking components. This is compounded by the fast pace of technological innovation and the high turnover rates for Navy personnel. This will be a continuing problem for advanced technical solutions and a transition to the more familiar PC platform should be accelerated as much as possible.

IMPACT/APPLICATIONS

The success of COAMPS in the on-scene environment is significant and has been recognized by CAPT David G. Markham as "… a monumental achievement that will undoubtedly have a far reaching impact on our future METOC CONOPS." The ability of COAMPS to resolve mesoscale features influenced by complex terrain, and the interface of the simulation data to decision aids, will be of great value to the Navy by improving the safety of operations and enhancing the ability of forward-deployed forces to exploit the environment for tactical advantage. TAMS/RT allows an unprecedented capability to the forward deployed operator to tailor the COAMPS domain and output products for the particular mission of their end-state user.

TRANSITIONS

TAMS/RT transitions to an existing 6.4 program (PE 0603207N X0513-05): the On-Scene Tactical Atmospheric Forecast Capability (STAFC), a component of the Navy Integrated Tactical Environmental Subsystem (NITES I). The Commander, Naval Meteorology and Oceanography Command (CNMOC) has recently adopted the advanced METOC operations concept demonstrated successfully by TAMS/RT and has announced plans to field TAMS/RT at all METOC Centers (Rota, Spain; Norfolk, VA; Pearl Harbor, HA; Yokosuka, Japan; and Monterey CA.

RELATED PROJECTS

Related 6.2 projects within PE 0602435N are award numbers N0001498WX30164 (EM/EO Testbed), N0001498WX30165 (COAMPS improvements for on-scene modeling), N0001498WX30166 (development of radar data assimilation techniques), and N0001498WX400008 encompassing the following NRL base projects: BE-35-2-18 (mesoscale model development), BE-35-2-19 (data assimilation technique development), BE-35-2-20 (aerosol modeling), BE-35-2-21 (visualization), BE-

35-2-26 (satellite remote sensing methods), and BE-35-2-44 (moisture parameterization). The related 6.4 projects under PE 0603207N are X0513-05 (STAFC) and X1752-01 (TEDS).

REFERENCES

Mundy, J., J. Cook, and L.N. Migues, 1998: User Manual for the Tactical Atmospheric Modeling System/Real-Time (TAMS/RT). A&T Tech. Report.

IN-HOUSE/OUT-OF-HOUSE RATIOS

Based on funding level, 31% in-house, 69% out-of-house; however, this project has a large hardware component (48% of total funding) which is included in the out-of-house portion. Eliminating the hardware component altogether, the ratios for the remaining 52% of total funding are 60% in-house and 40% out-of-house.